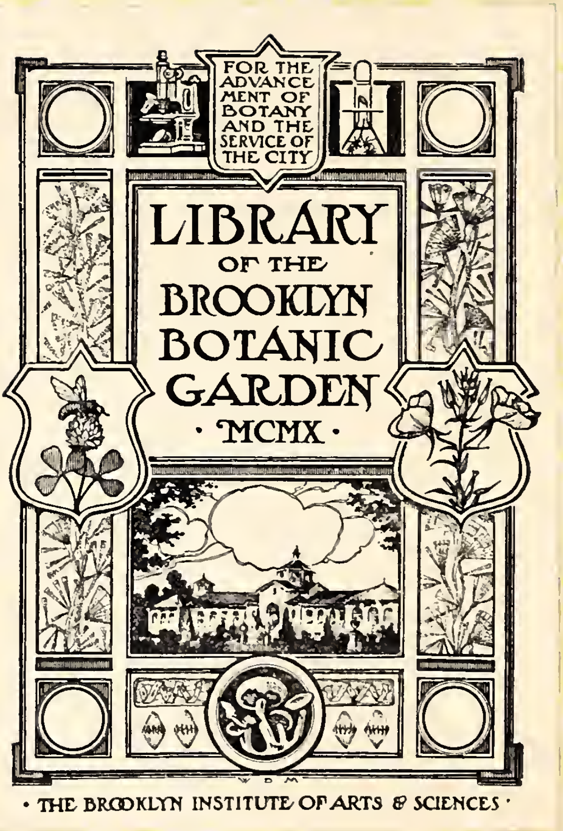

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BROOKLYN BOTANIC GARDEN

LEAFLETS

SERIES XXII BROOKLYN, N. Y., FEBRUARY 28, 1934 NO. 1-2

THE COLLECTION OF LIVING CYCADS AT THE BROOKLYN BOTANIC GARDEN

In the number of genera and species represented, the collection of living cycads at the Brooklyn Botanic Garden is one of the most comprehensive in this country. It is for the purpose of calling attention to this unusual collection, and also to explain briefly the significance of these interesting plants, that the present LEAFLET has been written.

What a Cycad is

By the uninitiated, cycads might easily be mistaken for ferns, since the leaves in some genera look somewhat like those of ferns. Even the initiated can be misled by the resemblance, for *Stangeria,* the most fern-like member of the group, was first described in 1836 as a species of fern (*Lomaria coriacea* Kunze). Those who have seen tree ferns will recognize the resemblance to these plants. The Cycads also resemble palms, since many kinds have a stocky, cylindrical trunk bearing a crown of leaves at the top in palm-like fashion. Dr. Chamberlain says, in his excellent little book entitled "The Living Cycads," "By the natives the various cycads are usually called palms, so that we have the sago palm, bread palm, Dolores palm, and other palms; but to the botanist, who knows that they are intimately related to the ferns and not even distantly related to the palms, they look more like ferns. And they deserve to look like ferns, for they have retained the fern leaf of their ancestors from the Paleozoic age down to the present."[2]

The Place of Cycads in Plant Classification

What makes the cycads of particular interest is that, although they are related to the ferns, they bear seeds, and are the modern representatives of the first seed plants. Since these seeds are borne naked, i.e. not enclosed in an ovary or pod like the seeds of the squash or the pea, they are classed with the great group of naked-seed plants, the *gymnosperms,* to which the pines, spruces, firs, and other

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[1] LEAFLET No. 7-8 "Hay fever—a study in applied botany," concluded Series XXI, 1933.

[2] Chamberlain, C. J. The living cycads. p. 1. Univ. of Chicago Press, 1919.

cone-bearing trees belong. The nearest relative of the cycads among the other gymnosperms is *Ginkgo,* the Maidenhair Tree, with its somewhat fern-like type of leaf and swimming sperms. The cycads and *Ginkgo* are the only seed-bearing plants which have retained these swimming sperms, a reminiscence of their ancestors which required water for fertilization of the eggs.

Cycads and Dinosaurs

The position occupied by the cycads in the plant world may be compared with that of the dinosaurs in the animal world. For the mammals, the dominant animals of today, doubtless sprang from some lowly reptilian race, while the flowering plants trace their ancestry to relatives of the cycads.[1] If giant dinosaurs were alive today—survivors of that colossal, lizard-like tribe, some of them probably eighty feet long and weighing nearly forty tons—if some of these creatures, or rather, their descendants, still roamed the earth, the resulting thrill to the zoologist would be similar to that experienced by the botanist when he considers the cycads. Both of these plant and animal races—the cycads and the dinosaurs—flourished in the same geological age—the Mesozoic—perhaps 100,000,000 years ago, and so the Mesozoic has been called the age of dinosaurs as well as the age of cycads.

What a Seed is

There is little doubt that the success of the higher plants, that has resulted in their dominance of the vegetation on the earth today, is largely due to their "seed habit." In the ferns and mosses, as well as still lower plants, reproduction, both asexual and sexual, evidently depends too much on chance. But when nature invented a seed, much of this dependence on chance was eliminated. Seed-production means better care of the next generation (strictly, the next life cycle). The higher plants, like the higher animals, "take care" of the next generation. A typical seed is composed of one or more seed-coats, which serve as a protecting cover, an embryo, which is a tiny, baby plant, and, in addition, a store of food to nourish the embryo in its new world until it can shift for itself. This food is either packed around the embryo, or may be even stored in the embryo itself.

Vegetative Characters of the Cycads

The more familiar kinds of cycads have a columnar trunk which is covered by the bases of old leaves. These old leaf bases, somewhat rhombic in outline, and with a very close spiral arrangement, constitute the "armor" of the trunk. "Since the armor, in the columnar forms, persists throughout the life of the plant, it is possible to determine within reasonable limits the number of leaves which it has produced. To determine the age it is necessary to count the number of leaf bases, and to know the average number of leaves produced in a year. This yearly average can be determined only by observations extending over a considerable period of time. A simple case may be used for illustration. The Mexican *Dioon edule* forms a new crown every other year, and there are about twenty leaves in a crown, so that the average is ten leaves a year. If there are ten thousand leaf bases the plant is about one thousand years old."[1] Usually the stem is unbranched (at least apparently) and this is another feature which causes these plants to resemble palms.

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[1] Wieland, G. R. Antiquity of the angiosperms. Proc. Internat. Cong. Plant Sci. **1**: 429-456. Pls. 1-5. Figs. 1-8. 1929.

"The tallest of all cycads is *Macrozamia Hopei,* of northern Queensland, which occasionally reaches a height of sixty feet; *Dioon spinulosum,* with an occasional specimen fifty feet in height, comes next; and the Cuban *Microcycas,* with here and there a specimen over thirty feet in height, is third. But these are all exceptional figures, even for these species; very few of them get beyond twenty feet. Among the remaining columnar forms any plant reaching a height of ten feet must be regarded as very tall."[2]

Other representatives of the group have a tuberous type of stem which is partly underground. This type of stem varies from an inch in diameter and a few inches in length to a foot in diameter and two feet in length, and may be seen in the smaller cycads, *Zamia, Bowenia,* and *Stangeria.*

In connection with a discussion of the vegetative characters it may be mentioned that, in general, most species of the cycads inhabit dry places. In accordance with this habitat, they have, in general, extensive root systems. "There is a main tap root which tapers gradually and extends down to a great depth, so that small amounts of water are brought up even when the surface soil is very dry."[3]

Cycads and Plant Evolution

It used to be thought that a large part of the vegetation of the Carboniferous division of the Paleozoic era consisted of true ferns. It is now known that more than half of these ancient forms were *Seed-ferns,* that is, on the margins of their leaves they bore seeds comparable with those of the cycads and of the flowering plants of today.[4] The Mesozoic cycads were evidently descended from these seed-ferns. The modern cycads, of which the genus *Cycas* may be regarded as the most primitive, are doubtless descended from Mesozoic cycads. From the Mesozoic "flowering cycads" or Cycadeoids (Bennettitales) the flowering plants probably trace their pedigree.

In former geologic ages, as already indicated, the cycads were more widely distributed than at present. Evidence of this is given by the fact that eleven species have been found fossil in rocks of the Comanchian period of the Mesozoic in Greenland, and the Triassic areas of Virginia and North Carolina have yielded twenty-three species.[1] A species of cycadeoid has recently been described by Chrysler as occurring in the Raritan formation of the Upper Cretaceous at Woodbridge, New Jersey.[2]

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[1] Chamberlain, l. c. pp. 71, 72.

[2] Chamberlain, l. c. p. 69.

[3] Chamberlain, l. c. p. 85.

[4] Schuchert and Dunbar, Textbook of Geology. 3rd ed. Part II. John Wiley & Sons. New York, 1933. p. 259.

Present World Distribution of Cycads

At present about sixty-five species belonging to nine genera are known in the tropics and sub-tropics of the Old and New Worlds (see map). In America the center of distribution is in southeastern Mexico, where three genera, *Dioon, Ceratozamia,* and *Zamia* occur. The first two genera are limited to Mexico. *Zamia* extends throughout Central America and the West Indies to Bolivia, where it is abundant in the region of the tropical Andes. Single species extend eastward into Brazil. *Microcycas* is of entirely local occurrence in the mountains of western Cuba. In the Old World, *Cycas* is the most widely distributed of the group, extending from southern Japan and southern China southwestward to and including Madagascar and small adjacent islands. Its range also includes Malaysia, Papua, northern and a part of eastern Australia, and a part of Polynesia. Africa has two endemic genera: *Encephalartos* and *Stangeria. Stangeria* has only one species and is confined in its distribution to a comparatively small area in southeast Africa, while *Encephalartos* occurs mainly in southeastern Africa, with one species widely distributed in tropical Africa. Eastern Australia has, besides *Cycas,* two endemic genera: *Bowenia,* with one species, in Queensland, and *Macrozamia,* with a rather large number of species extending well to the southeast; some *Macrozamia* species occur also in central and western Australia. Altogether, there are nine species of this latter Australian genus.

The Cycads at the Brooklyn Botanic Garden

The cycads at the Brooklyn Botanic Garden are exhibited in House 12 of the Conservatories. This is reached by taking the first door to the left after entering the Central or Economic House at the main or Garden entrance, and passing through House 11. In this house all of the extant genera of cycads are represented, as follows:

1. *Cycas circinalis* L.
2. *C. media* R. Br.
3. *C. revoluta* Thunb.
4. *Bowenia spectabilis* Hook. variety *serrulata* André
5. *Macrozamia Moorei* F. Muell.
6. *M. tridentata* (Willd.) Regel
7. *Stangeria paradoxa* Th. Moore
8. *Encephalartos Hildebrandtii* A. Braun
9. *Dioon edule* Lindl.
10. *Microcycas calocoma* (Miq.) A. DC.
11. *Ceratozamia mexicana* Brongn.
12. *Zamia floridana* A. DC. var. *Purshiana* Schuster

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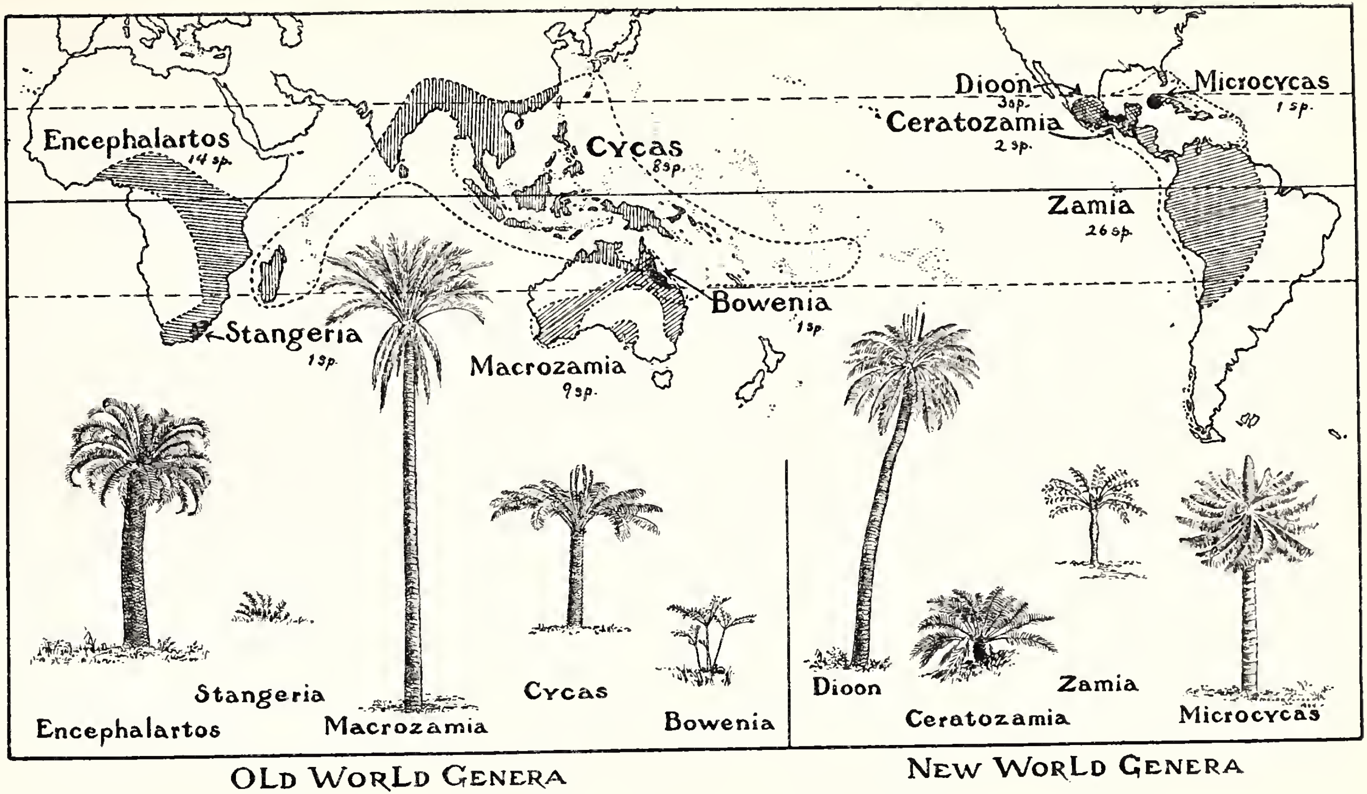
[1] Schuchert, Charles. Historical Geology. (Part II of A Textbook of Geology.) John Wiley & Sons: New York, 1915. pp. 819, 878.

[2] Chrysler, M. A. A new cycadeoid from New Jersey. Amer. Jour. Bot. **19:** 679. 1932.



Map showing world distribution of the Cycads.

It should be stated that all species of cycads are dioecious, i.e., have two different kinds of individuals, called, for the sake of convenience, male and female plants, the "males" bearing the stamens, and known also as staminate individuals, and the "females" bearing the ovules and seeds, and known also as the ovulate or carpellate plants.

The genus *Cycas* can be readily distinguished from all the other genera by the fact that its leaflets have only one vein or "nerve," which runs lengthwise down the middle of the leaflet.

Perhaps the handsomest plant in the whole collection is *Cycas circinalis,* a native of the East Indies and other parts of the Old World tropics. Its large, graceful leaves rise nearly to the roof of the conservatory. The red-brown scale leaves, or *cataphylls,* which precede the foliage leaves in development, show well here, hugging closely to the trunk. Specimens of *Cycas media* will also be seen nearby, in fine condition—both male and female plants. A male specimen of *Cycas media* has just (December, 1933) borne a new crown of leaves, thirty-two in all. These can be readily distinguished by their lighter green color. We see also the scale leaves, short, brownish, fuzzy outgrowths at the base of the new crown of foliage leaves.

Three plants of *Cycas revoluta* will be seen. One of these has just formed a new crown of leaves, and is therefore particularly handsome. This species is one of the best known of all cycads, much grown by florists and in private conservatories. The seeds are eaten by the natives of the regions where it grows, and from the pith of the stem a kind of sago, or starchy food, is prepared, on account of which it is often known as the "Sago Palm." It is said that in ancient times it was forbidden to export this species from Japan on pain of death, for it represented a supply of food which could be used at periods of famine, yielding nuts, sago, and brandy.[1] It is this species also that usually furnishes the so-called "palm" leaves, now much used in funeral decorations.

When the carpellate plants are bearing seeds, the contrasting colors of the bright red seeds, the tan-colored carpels (spore-bearing leaves), and the dark green foliage leaves, make a beautiful picture. The Brooklyn Botanic Garden has a colored souvenir post-card of one of these "fruiting" crowns reproduced from one of the plants in the Garden's collection.

Bowenia, represented here by its single species, *spectabilis,* and the variety *serrulata,* is of great interest because it is one of those members of the family that have tuberous stems, growing partly above and partly below the ground. Its stem here resembles an almost completely buried, huge turnip, at one side of which a single leaf is attached. This leaf, unlike those of all the other genera, is twice pinnate. The venation of the leaflets, with the numerous parallel veins, is quite unlike that of *Cycas.* Moreover, some of the veins are repeatedly branched dichotomously. The variety, first noticed by

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[1] Schuster, J. Das Pflanzenreich. Vol. 4, Pt. 1. Cycadaceae. p. 48. 1932.

Dr. Chamberlain, has leaflets with a toothed or *serrate* margin, hence the name *serrulata*. The plant at the Garden is one of a collection shipped July 29, 1914, from the Rockhampton Botanic Gardens, New South Wales, Australia, through the cooperation of Mr. R. Simmons, Curator. This shipment, including specimens of *Macrozamia* and *Cycas media,* was delayed many months on account of the World War, being transferred from one British ship to another. After an arduous trip of about seven months' duration, the plants arrived at the Garden on February 16, 1915. Dr. Gager, the Director, wrote, at the time, "To our surprise and satisfaction, most of them appeared to be in good condition. The *Bowenia* has a stem best described as resembling an abnormally large turnip, while the stems of the *Cycas* and Macrozamias are thick and succulent, that of the *Macrozamia "spiralis"* being semi-tuberous. All the plants were, of course, devoid of foliage, and these facts, combined with the very careful manner in which they were packed, contributed to keep the plants alive during their seven months of transit and drought. Some of the seeds of the Macrozamias had germinated, but the seedlings did not live. It is probable, however, from present indications, that one or more specimens of each sex of all the four species will survive."[1]

Another plant that is decidedly different from the other members of the family is *Stangeria,* represented here by its only species, *paradoxa*. The leaflets are *pinnately veined* as contrasted with the single central vein of *Cycas* and the parallel veins of *Bowenia, Macrozamia,* and the rest. As Dr. Chamberlain says, "It is the most fern-like of all the cycads"—one sees how easy it was to class it as a fern, a mistake which "was not corrected until the cones were discovered."[2] In its natural African environment the thick, tuberous stem is entirely underground, sometimes branched at the upper end, as in one of the specimens exhibited here. The woolliness at the base of the leaf stalk is also a striking character as well as the localized growths of cork on the exposed parts of the stem. The plant was named in honor of Dr. Stanger, Surveyor General at Natal, who sent a plant to England in 1851.

Several fine specimens of *Macrozamia* (*tridentata* and *Moorei*) are conspicuous in the collection, all of which are part of the shipment from Rockhampton above mentioned. A male plant of *Macrozamia tridentata* (*spiralis*) is just now developing two cylindrical young cones which are now about six or seven inches long and nearly two inches thick, in which the microsporophylls (which correspond to stamens in the flowering plants) may be observed, very closely packed together, each one armed with a long point. This pointed character of the microsporophylls is one of the features which distinguish this genus from *Encephalartos* with its blunt microsporophylls. A point of interest here is the pronounced callosities at the bases of the leaflets. *M. tridentata* differs from *M. Moorei* in having a more subterranean trunk and in its somewhat narrower leaflets, as well as in other characters.

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[1] C. S(tuart) G(ager). Rare cycads from Australia. Brooklyn Bot. Gard. Record **4:** 83-92. 7 figs. 1915.

[2] Chamberlain, l. c. p. 42.

The African genus *Encephalartos* gets its name from the fact that the natives make meal of the starchy seeds, and hence bread (Greek, *artos*). Literally it means "bread in heads," referring to the way in which the seeds are borne in cones. By the natives it is known as the Bread Palm. The leaflets here are broad and toothed.

Dioon edule is represented by a fine specimen which has been at the Garden since 1917. *Dioon* means "two eggs," referring to the fact that each macrosporophyll or carpel bears two ovules, but this, as a matter of fact, is a character common to all the cycads except one genus. It is called *"edule"* because the Mexicans make *"tortillas,"* round, thin cakes, from a meal obtained from its seeds. Dr. Chamberlain says that this "plant grows in the blazing tropical sun and is a prominent feature of the landscape, although its stocky trunk seldom reaches a height of more than four or five feet. But even at this height it towers above fully grown oak trees which remind one of the artificially dwarfed evergreens of Japan. Some other associates are wild pineapples, cacti, and various peculiar ferns which are able to survive under such dry conditions."[1]

Two vigorous male plants of *Ceratozamia mexicana* will be found close by, in the Garden's collection, with young cones just now forming. The cones show clearly the two horn-like processes on the scales which give the genus the first part of its name. The broad, parallel-veined leaflets, so different from those of *Cycas,* for example, should be noted here.

The specimens of the rare *Microcycas calocoma* of Cuba are easily identified: the specific name means "beautiful hair," perhaps referring to the leaves, but the flat, sharp pointed leaflets, so stiff as to make the whole leaf stand out in a single plane, produce an effect more closely resembling an enormous two-sided comb, with flat teeth.

A small specimen of *Zamia integrifolia* var. *Purshiana* completes the collection. This is the only genus which occurs native in the United States. Two species grow wild in Florida, and there are several species in Porto Rico. It is one of those genera with a tuberous stem partly sunken in the ground.

The accompanying illustration was drawn by Miss Maud H. Purdy under the supervision of the authors.

ARTHUR HARMOUNT GRAVES
ALFRED GUNDERSEN

The Conservatories are open to the public without charge from 10 a.m. to 4 p.m. on weekdays, from October 1 to March 31 (Sundays 2-4 p.m.). From April 1 to September 30 they are open from 10 a.m. to 4:30 p.m. (Sundays 2-4:30).

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[1] Chamberlain, l. c. p. 14.

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BROOKLYN BOTANIC GARDEN

LEAFLETS

SERIES XXII BROOKLYN, N. Y., MARCH 21, 1934 NO. 3-4

PRUNING ORNAMENTAL TREES AND SHRUBS*

Contrary to a widely accepted belief, the vast majority of ornamental trees and shrubs do not require extensive annual pruning. Consequently, one is tempted to give the would-be pruner the famous advice that Mr. Punch gave to those about to be married—"Don't!" Much harm to plants may ensue when pruning saw and shears are used by unskilled hands; and those who are ignorant of the "whys and wherefores" of pruning are advised to restrict their pruning to the removal of dead, diseased, and scale-infested branches. If this advice were generally followed we would not see so many Forsythias mutilated by shearing with hedge shears in winter with consequent distortion of habit, and fewer flowers the following spring; and there would be fewer tales of the failure of Wisteria and French Hydrangea to blossom, brought about by severe pruning in spring.

It must not be inferred from the above that pruning is altogether a bad practice. It is possible by pruning to aid the rejuvenation of sickly plants and assist in the control of insect pests and fungous diseases. Pruning may be used to correct faulty habits of growth and to bring about earlier blossoming. By reducing the number of growth buds on shrubs which produce their flowers on shoots of the current season, it is possible to develop larger flowers on longer stems; and pruning or shearing is almost essential in the production of hedges, and plants of special outline for use in formal gardening.

Following are some of the considerations that should actuate anyone engaged in pruning practices.

Dormant Pruning

Severe pruning when the plant is dormant usually results in the production of strong vegetative shoots during the following growing season. The commonly accepted reason for this is that the food supply rising from the roots is concentrated in a few growth buds instead of being dissipated over a large number of buds.

Severe pruning may be rejuvenational in its effects when properly applied and associated with augmented feeding at the roots. Thus, old shrubs which are making poor growth may be given a new lease of life if cut almost to the ground. It should, however, be recognized that such pruning is to be avoided as much as possible. In the case of shrubs whose blossoms originate from wood of the preceding year, one year's blossoming is lost; and possibly two, if the vegetative growth induced by severe pruning is so strong that no blossom buds are formed. Furthermore, it sometimes happens that such drastic treatment, by completely upsetting the balance between roots and top, brings about the demise of the plant. The ideal treatment for shrubs that tend to become decrepit with age is to maintain constant juvenility by the removal, annually, if necessary, of old, worn-out wood. Shrubs that are amenable to this treatment include Philadelphus, Deutzia, Lilac, Weigela, Forsythia, etc.

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* Concrete examples of the principles embodied in this Leaflet were exhibited by the Brooklyn Botanic Garden at the International Flower Show, Grand Central Palace, New York City, March 19-24, 1934.

Old, devitalized trees may sometimes have their vigor renewed by cutting back up to one-third of their top growth when dormant. A nice sense of judgment is necessary to insure that enough is cut off to be of benefit, but not so much that it results in the production of a thicket of sappy watersprouts. In general, the cuts should be made close to branches pointing in the direction it is wished to have the tree develop.

Occasionally we have to deal with a tree which is well-placed and vigorous, but which, because of neglect or of just plain perversity, has developed a faulty habit, weak crotches, and crossing branches. Such a tree might well require the removal of half or more of its top growth to bring it into the semblance of symmetry. In order to avoid the dangers of lack of balance between top and root, it is well either to spread the corrective pruning over several years; or to cut out about half of the wood marked for removal during the winter, and then check the over-vigorous growth by removing the remainder during the following summer.

Trees and Shrubs which Blossom on Old Wood

Shrubs or trees which produce their blossoms on wood that is one year old or older cannot be extensively pruned when dormant without lessening the number of flowers produced the following spring. It does not necessarily follow that pruning this class in winter, or when dormant, is absolutely prohibited. Lilacs may be pruned when dormant without much loss of bloom the following season if the parts removed are restricted to suckers and weak spindling branches. And, on occasion, branches bearing flower buds may be deliberately sacrificed in order that those remaining may have a better chance to develop. It is usually recommended to prune Forsythia and other early-blooming shrubs immediately after flowering, but pruning can often be done to advantage during the winter and the prunings used to force into bloom indoors for use as cut flowers. As a general practice, however, it is well to prune these early-blooming shrubs which flower on old wood immediately after they have finished flowering. Pruning should consist of the removal of old worn-out wood (a thinning process) and correcting any irregularity of growth, always remembering that too little pruning is far preferable to too much.

Cutting the flowers with long stems for indoor use serves, in part, the same purpose as regular pruning, and in some cases, (e.g. Lilac) is an important means of preventing the plants from increasing too rapidly in height.

Although the Pussy Willow is early-blooming, and produces its flowers on wood of the preceding year, cutting back, in the spring, the shoots of the preceding year to one or two buds is indicated if it is desired to have the "pussies" produced on long, whip-like growths. Those who prefer to see the "pussies" displayed on short, twiggy growth should refrain from any extensive pruning.

Shrubs which produce their flowers on shoots of the current season may be pruned, often to great advantage, by cutting them back just as growth is starting in the spring.

Shrubs which Bloom on New Wood

Roses of the Tea, Hybrid Tea, and Hybrid Perpetual classes belong in this group. If roses of "exhibition" quality are required, the pruning is severe, leaving only three or four canes to each bush, with three growth buds to each cane. If the preference is to produce a larger number of good flowers suitable for cutting, the pruning should be moderate, and the canes cut back to six or eight buds; but if a large number of flowers for garden display is desired, and there is no objection to short-stemmed blossoms, pruning should be restricted to the removal of spindling wood, the tips of the canes and, of course, dead or diseased wood.

The Roses that are commonly used for furnishing arbors, trellises, pergolas, and pillars, present an entirely different problem. The "rambler" type, exemplified by "Excelsa" and "Dorothy Perkins," flowers best on laterals originating from canes of the preceding season. Consequently, the flowering canes should be cut at the ground line immediately after the flowers are faded; thus making room for the shoots, arising from the base, which will carry the blossoms the following year. Strong-growing varieties such as Dr. Van Fleet and "Silver Moon" belonging to the "climbing" type, which has a more or less permanent superstructure, should not be planted where there is insufficient room for them: the severe cutting back necessitated to keep them within the confines of small areas results in strong vegetative growth but few, if any, blooms. Pruning in this class consists of shortening laterals in spring and the removal of old, worn-out wood. Laterals may be cut back after flowering but, on the whole, it is better to leave them, as many roses of this type produce attractive fruits in the fall if the flowers are not removed. "Pillar" roses which have a similar habit to that of the preceding, but which are not nearly so rampant, need little pruning beyond the removal of old, worn-out wood.

The Pee Gee Hydrangea may be pruned in late winter or early spring by cutting back the shoots made the preceding year to within one or two buds of their point of origin. This results in strong shoots bearing enormous panicles of flowers, but it also results in an ungainly plant and many of us think that more pleasing effects are obtained when this shrub is left unpruned, or the one-year shoots cut back lightly—say, about one-third. Much the same remarks are applicable to Shrub-Althaea, except that in this case the flowers are produced along the shoots of the current season and not in panicles at the tips.

When it comes to Buddleia (Summer Lilac) and shrubs of similar habit, it is possible to make out a good case in favor of drastic spring pruning. In the first place, in our climate, Jack Frost is likely to take the matter out of our hands by killing the tops almost to the ground so that, willy-nilly, the pruner must use his shears with reckless abandon. Secondly, this shrub differs widely from the Pee Gee Hydrangea in that the shoots of the current season branch freely and flowers are formed on both lateral and terminal shoots so that the objections which apply to severe pruning of the Hydrangea are not applicable to Buddleia.

In shrubs which are grown for the effect of their twigs in winter* the brightest color is seen in the young twigs. Because of this it is commonly advised to cut back these shrubs severely just before growth starts in the spring. However, unless this heavy pruning is followed up in summer by pinching out the tips of the strong growth to stimulate free branching, the result is likely to be unsatisfactory because the long, whiphandle growths are far less attractive than an abundance of shorter, twiggy shoots. A better plan is to cut out annually old, weak branches of poor color and shorten the strongest shoots.

Summer Pruning

Summer pruning applied to shrubs which are making vigorous vegetative growth may, by checking their exuberance, bring about increased flower-bearing. This statement is not universally applicable, and observation and thought should be used before putting it into extensive practice. It may work very well with non-blooming Wisterias if the long trailing shoots which are produced in early summer are cut back at the right time. If they are cut too soon, dormant buds start into growth; if pruning is deferred too long, nothing is accomplished beyond shortening the shoots. Observation must determine the correct time to cut back these shoots to within three or four buds of their point of origin. This should be done just before the shoots have attained their maximum length. The theory is that the check to growth occasioned by the removal of growing parts, at a time when food is still rising from the roots, results in the conversion of growth buds into flower buds.

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* *Cornus stolonifera, Salix vitellina* vars., etc.

If a vigorously growing Wisteria persistently fails to bloom it is worth while to prune it in summer with the object of causing it to form blossom buds. If this fails, root pruning should be resorted to.

Summer pruning of shrubs which do not have a definite season of growth, but which continue to produce new shoots and flowers so long as temperature and moisture conditions remain favorable, belongs in a different category. The flowers of ever-blooming roses such as China, Tea, and Hybrid Tea, may be cut with long stems leaving only two or three growth buds on the shoot of origin. This promotes the production of strong flower-bearing shoots from the remaining buds. If merely the faded flowers are removed a greater number of flower-bearing shoots are likely to develop, but they will not be so vigorous. It all simmers down to the question of whether long-stemmed roses are desired for cut flowers or a quantity of blooms for garden display in which the length of the stems is immaterial.

Pruning to Develop a Compact Habit

Removal of the tips of growing shoots usually results in stimulating buds into growth which normally would have remained dormant, thus promoting a compact twiggy habit. Light "heading in" of shoots of the preceding year, when the plant is dormant, serves a similar purpose. We make use of this principle in shearing hedges and in trimming to symmetrical outlines plants used in formal gardening. Deciduous hedges, such as those of California privet, are usually trimmed two or three times during the growing season although the shearing may be more frequent if an extra neat, close habit is required. This frequent trimming serves to diminish the size of the leaves produced on subsequent shoots so that the effect, at a distance, approximates that of boxwood. Evergreen hedges are usually trimmed less frequently. Some operators prefer to shear evergreens just before growth starts in the spring and some prefer to do it in early summer. When it is necessary to thicken up the growth of firs and spruce it is done by cutting back the end shoots when the new growth has developed. In the case if pines it is done by shortening the "candles" when they have attained their full length but before the needles have unfolded.

Shearing should not be practised except when it is desired to produce plants having special definite outlines. Judicious shortening of exuberant growths which tend to spoil the normal symmetry of a species may, however, be practised to advantage. In special cases when it seems necessary to promote the production of a branch in a certain direction and it is considered undesirable to cut away any portion of the tree or shrub, a properly situated dormant bud may be made to start into growth by cutting a notch, extending into the sapwood, immediately above the bud. This partially interrupts the flow of sap towards the end of the branch, which finds an outlet by forcing the bud into growth.

Pruning as a Factor in the Control of Disease

Pruning may be an important factor of aid in the control of insect pests and plant diseases. Shrubs and trees that are badly infested with scale insects should have the worst infested branches removed if this can be done without completely destroying their symmetry. This pruning serves the double purpose of cleaning up a large part of the infection and of stimulating the growth of the remaining branches. Such pruning should, of course, always be accompanied by appropriate spray treatment. The removal of infected branches or the cutting out of cankers is an important part of the treatment indicated in the control of such bacterial and fungous pests as fire-blight and apple canker. On the other hand, watersprouts and other soft, sappy, growth induced by excessive pruning are favorite feeding grounds for aphids, and are highly susceptible to attack by fire-blight.

Pruning Newly Transplanted Trees and Shrubs

Newly planted trees and shrubs usually are benefited by pruning the top to compensate for the loss of roots and injury occasioned by removal. The amount of pruning necessary is dependent upon the care with which the plants have been transplanted, the species involved, their age, and whether or not they have been frequently transplanted. Evergreens are usually dug with considerable care, balled and burlapped, and, as a rule, need little or no pruning. If, after they are settled in their new quarters, they show signals of distress, the removal of part of their growth may aid in bringing them through. In pines the wilting "candles" may be shortened; in spruces and firs the new growth, or the shoots of the preceding year (depending upon the stage of growth), may be trimmed back; and conifers of a feathery habit such as Retinospora may receive a light shearing. Rhododendrons and related plants have a fibrous root system and transplant easily, so that it is seldom necessary to prune them; although in special cases it may be desirable to sacrifice the floral display for one year, by removing the flower buds for the ultimate good of the plant.

In the case of deciduous trees and shrubs, when the subject is known to transplant easily, the removal of broken, weak, and rubbing branches may be all the pruning necessary. At the other extreme are trees which are difficult to transplant, and severe pruning usually helps them to recover. At the Brooklyn Botanic Garden we have had good success with oaks which are difficult to transplant, by cutting them back almost to bare poles when transplanting them. This is possible because the oaks "break" well from old wood.

It is difficult to say just how much to cut from a tree or shrub at transplanting time. So much depends on the nature of the tree, the amount of roots lost, whether or not the roots have been subjected to drying, and the after-care that it is possible to give them. As a rough guide it may be said that weak branches should be cut away if it may be done without spoiling the shape of the tree, and the growths of the preceding year shortened from one-third to two-thirds. If after a few weeks the twigs seem to be shrivelling, a further cutting back may be practised to advantage. At transplanting time any mangled roots should be cut back to sound tissue with a sharp knife or pruning shears.

Position of the Cuts

The cuts in pruning should be made just above a bud, or buds, pointing in the direction it is wished to have the bush or tree develop. When large branches are involved they should be removed by cutting close to, and parallel with, the axis of the parent branch or trunk. The object of this is make the wound close to an active part of the tree or shrub so that it may quickly be healed over by the growth of callus tissue. If stubs are left, they are almost certain to die because there is no flow of sap through them. When the stubs die, decay will set in which may extend into the trunk far beyond the original stub.

When cutting out branches of considerable weight, grave injury to the tree may result if certain precautions are not observed. The first cut should be made about a foot from the point where the final cut is to be made and *should be an upward cut from beneath the branch.* Continue cutting until the saw binds. The second cut should be two inches nearer to the trunk and from the top of the branch downwards. This results in the removal of the branch without any danger of slivering the bark of the trunk. There now remains a stub which may be removed without injuring the bark of the trunk, because it may be steadied with one hand while the few last cuts with the saw are being made.

Wound Dressings

Although in some quarters doubts are cast on the desirability of treating wounds (especially those less than two inches in diameter) with substances designed to prevent decay, the consensus of opinion seems to be that some protective substance should be applied, at least to the larger wounds. A wound dressing should inhibit the germination of spores of disease-causing organisms, prevent the checking of the wood, and at the same time be non-injurious to the living tissue of the cambium layer and vicinity.

Experiments carried out by the U. S. Dept. of Agr., Yale University, and the Bartlett Tree Research Laboratories in collaboration,* seem to indicate that the best material for this purpose is the bordeaux paint developed by Dr. S. M. Zeller of the Oregon State Agricultural College. This consists of equal parts by weight of commercial dry bordeaux mixture and raw linseed oil, applied with a stiff paint brush. A drawback to the use of this material is the conspicuous and unsightly color changes through which it passes.

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* Marshall, Rush P. Some experimental treatments of shade tree wounds. The Shade Tree **5**. No. 3. 1932.

A commercial preparation is now available for which it is claimed that the color of the material is "changed to meet the conditions of shade trees."

A thick paint made of zinc oxide and linseed oil forms a fairly satisfactory dressing that is conveniently obtainable by the average amateur gardener. Asphalt paints have been used with good results, and also coal tar when kept away from the edges of the wound to avoid injury to the cambium layer. It has been suggested that it would be a good plan first to apply rubber latex, melted beeswax or other preparations that are claimed to encourage callus formation, to the cambial region before applying the dressing which is designed to prevent checking and the ingress of disease-producing organisms.

Suckers from Grafted Plants

A close watch should be kept on grafted plants. If suckers arise from the understock, remove them promptly. In so doing cut them as close as possible to the parent stem so that no buds are left behind to cause trouble in the future. When suckers originate from below the ground level and it is not easy to cut them off they may usually be removed by an upward and outward pull. After a few trials one develops a knack of doing this so that the sucker is removed leaving no buds behind. Grafted roses, rhododendrons, lilacs, and flowering almond are some of the plants we should watch for suckers.

Tools

The tools used in pruning should be sharp. For small branches, a pruning knife skillfully used is probably the best tools, as its use involves a minimum of injury to the plant tissues. Pruning, however, can be done more expeditiously with pruning shears, and if these are kept sharp and carefully used, not much damage to surrounding tissues will result. Long-handled lopping shears are used extensively in pruning shrubs where the branches to be removed are around an inch or inch and a half in diameter. In the writer's opinion, however, branches an inch or more in diameter can be cut out more advantageously by means of a narrow-bladed pruning saw.

Conclusion

Most of our ornamental trees and shrubs are not improved by annual, or extensive pruning.

Except in special cases, the natural shape of tree or shrub should be maintained as far as is possible.

It is important to know when and where blossom buds are produced in order that pruning may not result in failure to blossom.

Pruning of the top to compensate for loss of roots at transplanting time is on the whole a good practice.

Pruning is a lifetime study and should be carried out thoughtfully, with careful observation of results, so that errors may be avoided in future practice.

MONTAGUE FREE

BROOKLYN BOTANIC GARDEN
LEAFLETS

SERIES XXII	BROOKLYN, N. Y., MARCH 21, 1934	NO. 5

THE EXHIBITS OF THE BROOKLYN BOTANIC GARDEN at the TWENTY-FIRST INTERNATIONAL FLOWER SHOW

GRAND CENTRAL PALACE, NEW YORK CITY

MARCH 19-24, 1934*

The chief exhibit of the Brooklyn Botanic Garden is on the main floor near the stairs at the Park Avenue end of the Grand Central Palace.

This exhibit consists of an exposition of the methods of pruning ornamental trees and shrubs. The deplorable effects resulting from erroneous pruning as well as the benefits to be derived from well-considered pruning are graphically depicted with living specimens.

Among the features of the exhibit are the following:

A Forsythia mutilated by clipping in winter with hedge shears. This is, unfortunately, an all too common practice which results in fewer flowers being produced the following spring, and in destroying the natural graceful habit of this shrub. The flowers lost by this hedge-shearing method applied to Forsythia are placed nearby, having been forced into bloom by placing the clippings in water, indoors, for a week or so prior to the exhibit. This specimen illustrates the ill effects of pruning both at the wrong time and in the wrong manner.

Another Forsythia shows the effect of pruning at the right time but in the wrong manner. This specimen was sheared immediately after it had finished blooming in the spring of 1933. It has plenty of flower buds, but its natural habit of growth is distorted.

A correctly pruned Forsythia is shown in which the shoots of three years and older are thinned out in early spring and forced into bloom indoors. Another specimen is shown with the branches painted that should be pruned out immediately after flowering.

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* Brooklyn Botanic Garden *Leaflet* No. 3-4, Series XXII, March 21, 1934, contains a more extended treatment of the methods of pruning ornamentals, and may be obtained at the Brooklyn Botanic Garden at ten cents a copy.

Several specimens of lilac are used to still further emphasize the fact that extensive winter pruning of the top growth of trees and shrubs which produce their blossoms on old wood means fewer flowers the following spring. It is pointed out by means of placards and painted parts of the bushes, that dormant pruning with shrubs of this class should be restricted to the removal of suckers and weak branches only; that old flower heads should be removed to prevent seeding (except, of course, when it is desired to secure seeds) thus conserving the energy of the plant. It is suggested that lilacs may be pruned, in part at least, by cutting the flowers with fairly long stems, and that this is an aid in preventing the bushes from becoming too tall.

A lilac also is used to illustrate in a striking way the fact that severe pruning in certain cases may be rejuvenational in its effects. This particular specimen was cut back in February, 1931. The new shoots produced that year attained lengths up to nearly five feet. In 1932 the new shoots were about two feet six inches in length, and in 1933 about one foot six inches. The extent of growth in these years is indicated in sample branches by attaching ribbons of different colors (accompanied by explanatory labels) extending from top to bottom of the growth of the various years. Heavy pruning such as this results in the temporary loss of the flower-bearing habit.

The principle that severe pruning of trees and shrubs which bear their flowers on old wood results in strong vegetative growth but few flowers is shown to perfection by two small, flowering crab-apples, which were of about equal size last spring. One was pruned severely in March, 1933, which resulted in the production of vigorous shoots up to four feet or more in length, but only a dozen or so flower clusters, while on the unpruned specimen the flower clusters may be counted by hundreds.

Pruned and unpruned specimens of French Hydrangea are also shown to illustrate this principle. Many people complain that their Hydrangeas never bloom, and questions sometimes elicit the fact that they were in the habit of cutting them to the ground every spring. Some varieties of French Hydrangea apparently refuse to blossom if the growth of the preceding year is cut back too far.

Established plants of hybrid tea roses are used to illustrate the method of pruning to obtain blooms with long stems and also the conservative pruning adopted when the length of stems is immaterial and a large number of blooms is required for garden display. Another series in which young plants are used demonstrates the pruning of fall and spring planted roses. Here both pruned and unpruned plants are shown with shoots of the latter painted to indicate the parts which should be removed.

The plants of Pee Gee Hydrangea, (1) unpruned, and (2) pruned last spring, illustrate the fact that shrubs which bloom on shoots of the current season may be pruned in spring with consequent increase in length of stems and size of flower clusters or flowers. It is also pointed out that, in some cases, heavy pruning results in an ungainly plant.

Three bushes of Shrub-Althaea or Rose of Sharon form an interesting group. One specimen was pruned in the spring of 1932, by cutting back the shoots made in 1931 to within one or two buds of their point of origin, but not pruned in 1933. Its companion was pruned in 1933. Nearby is a specimen that has not been pruned since it was planted. These shrubs provide a vivid object lesson of the change in habit of growth effected by pruning, and the comparatively graceful habit of the unpruned plant leads one to question whether the practise of cutting back in spring, so commonly recommended for this species, is one which should be supported.

The principle that light "heading in" of the shoots of the preceding year and shearing or pinching the growing shoots results in the stimulation into growth of dormant buds and the formation of a compact, twiggy habit, is shown by pruned and unpruned specimens of various evergreens, deciduous shrubs, and herbaceous plants.

Attention is directed to the desirability of pruning most newly transplanted stock by removing with a sharp knife or shears the ends of mangled roots and by reducing the top to compensate for loss of, and injury to, roots.

A grafted Azalea with suckers arising from the understock is used to indicate that it is important to remove these shoots lest they develop to the detriment of the top.

A conspicuous feature of the exhibit is a neglected and misshapen tree with some of its branches painted red and some yellow to suggest corrective pruning. Red paint is applied to branches which should be removed, because they cross and rub thus causing abraisions which may allow the entry of wound parasites. Yellow paint is applied to branches which might be removed to improve the appearance of the tree. To avoid the dangers of bringing about a lack of balance between top and roots by the heavy pruning necessary, it is suggested that it be spread over several years; or, as an alternative, that about half the wood marked for removal be cut out during the winter; then the over-vigorous growth can be checked by removing the remainder during the following summer.

Right and 'wrong methods of removing limbs from trees are demonstrated; and also the position of the cuts with reference to branches and buds.

A tree stump with wounds treated with various "protective" dressings is shown and also some of the tools used in pruning.

By the use of specimens of *Rhododendron, Corylopsis,* and *Spiraea Van Houttei,* which require little or no pruning, attention is directed to the fact that most of our ornamental trees and shrubs are not improved either in health or appearance by extensive annual pruning.

On the third floor, on a space twelve by six feet, the Brooklyn Botanic Garden is exhibiting a display of Crocus species and varieties. Nearly fifty species and varieties are represented, comprising both wild species and highly developed florists' varieties. Rock gardeners will be greatly interested in the half dozen different forms of the Scotch Crocus, because this is an excellent rock garden subject. Another species which has been prolific in the production of various forms is *Crocus chrysanthus,* of which eight varieties are represented. Many people think that among the *chrysanthus* forms are to be found the handsomest of all the Crocuses. The Cloth-of-Gold Crocus (*C. susianus*) is another good species for the rock garden and one of the earliest, as it usually opens its blossoms about the first week in March. The "old fashioned" winter that we are experiencing has made it possible for us to hold back *Crocus Korolkowi* for the International Flower Show. Normally it is liable to display its flowers under out-of-door culture by the end of February. This species comes from Turkestan.

In addition there are twenty or more named varieties of Dutch Crocus. These are Brobdingnagian fellows in comparison with the smaller, and to many people, more dainty, wild kinds.

Also on the third floor the Brooklyn Botanic Garden is exhibiting a male plant of *Ceratozamia mexicana* with a pollen-bearing cone eighteen inches long. This plant is a member of the Cycad family —of intense interest to botanists because cycads flourished in the Mesozoic era, perhaps 100,000,000 years ago. Only nine genera are now extant.

MONTAGUE FREE

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Entrances—On Flatbush Avenue: (1) near Empire Boulevard, and (2) near Mt. Prospect Reservoir. On Washington Avenue, (3) south of Eastern Parkway, and (4) near Empire Boulevard. On Eastern Parkway, (5) west of the Museum building.

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BROOKLYN BOTANIC GARDEN
LEAFLETS

Series XXII   Brooklyn, N. Y., April 25, 1934   No. 6

THE PLANTING AND CULTIVATION OF ANNUALS*

Before discussing the planting of the annual garden it might be well to define what is meant by the term "annual." To the botanist, an annual is a plant which grows from seed, produces its flowers, matures its seeds and dies in one season.

The gardener is sometimes not so strict in his definition, and places in the category of "annuals" many plants that are really perennials, such as snapdragons and four o'clocks, merely because it is more convenient to treat them as annual plants.

One of the advantages of raising annuals, and a factor of interest to the economically-minded gardener, is their comparatively low cost. In many cases it is possible to raise thousands of plants from a ten cent package of seeds. From a decorative standpoint annuals are of great value, because many of them have a long season of bloom and come in at the appropriate moment to provide a display of color after the early blossoming perennials have passed. As cut flowers they are almost indispensable. China asters, sweet peas, marigolds, calliopsis, zinnia, and larkspur are but few of the many annuals which can be used to bring color and charm into the home during the summer months.

Some of the annual plants are particularly well adapted to forming a temporary background in the garden. Suitable for this purpose and characterized by bold foliage are the castor oil plant and the sunflower. Hemp and cosmos are similar tall-growing plants, but their foliage is of a finer texture. It is even possible to form a rather attractive hedge with certain of the annual plants. The summer cypress, or kochia, is excellent for use as a hedge and so is the summer fir, which rejoices in the somewhat cumbersome botanical name of *Artemisia sacrorum viridis*.

There are, of course, many annual vines which grow quickly and which can be used to advantage in covering arbors and trellises. Included in this group are the balloon vine, with balloon shaped fruits which are a delight to children; the wild cucumber vine; dolichos or lablab; sweet peas; and morning glories.

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* Digest of a broadcast given by Mr. Montague Free, Horticulturist of the Brooklyn Botanic Garden, in connection with Cooperative Extension Work in Agriculture and Home Economics of the State of New Jersey.

Where our Annuals Come from

Did you ever stop to think about the origin of the annuals that we use for the adornment of our gardens? It is interesting to know that we draw on practically the whole world for our supply. The East Indies, for example, give us love-lies-bleeding and balsam. From China comes the ever popular aster; from far-away Australia, the Swan River daisy and the straw flower that is so valuable for dried winter bouquets. Africa is the home of the cape marigold and of lobelia; Europe of the snapdragon and sweet alyssum. Our own country provides one of the most valuable of all the low-growing annuals in *Phlox Drummondi,* which grows wild in Texas. Ageratum and cosmos come from Mexico, and, although it does not sound reasonable, so do the French and African marigolds.

Buy Seeds of Good Quality

Modern annuals have been greatly improved by cross-breeding and selection. Because of this improvement and because of their variability, it pays the gardener to buy a good strain of seed from a reliable seedsman. The amount paid for seeds of annual plants is as nothing compared to the value of the time and labor spent in growing them. It is "penny wise and pound foolish" to buy inferior seeds.

Sowing

The time for sowing annuals depends upon the types of seeds that are to be planted. Many of the hardy annuals may be sown to advantage in late fall. In this group are such plants as larkspur, poppies, cornflower and portulaca. Others of the hardy annuals, among them mignonette, sweet alyssum, and calliopsis, may be sown as soon as the ground is workable in early spring.

The half-hardy annuals may be started in flats during March, either in a greenhouse or cold frame, or they may be sown out of doors during May in the place where they are to flower.

The tender annuals give the best results when started early in a greenhouse or cold frame. In this group we have begonia, ageratum, lobelia and verbena. If the planting of their seeds is deferred until it is warm out of doors, the chances are that by the time they are beginning to make a display Jack Frost will come along and destroy them.

Preparing the Seed Bed

Now let us turn our attention to the question of planting. It is assumed, of course, that the soil has been thoroughly prepared, that it has been dug deeply and mixed with a liberal supply of decayed manure. An important factor in the planting of annuals out of doors is the preparation of a finely pulverized seed bed. This may be accomplished by raking the surface with an iron-toothed rake until all the lumps are broken and the surface soil is in fine tilth. In sowing fine seeds, merely scatter them on the surface of the newly raked soil and then rake it again lightly to cover the seeds. After this process the soil should be patted down gently in order that it may come in close contact with the seeds and that they may absorb the moisture necessary for germination.

With larger seeds that require covering to a depth of ¼-inch or more, it is a good plan to rake off a sufficient depth of the surface soil on the area to be planted. Then scatter the seeds, return the soil that was originally removed, and pat it down as before.

Seeds that are even larger and that will need to be spaced 6 inches or more apart may conveniently be put into the ground with a dibber or any kind of stick that will make a shallow hole. Sweet peas, castor beans, and sunflowers should be planted according to this method.

When annuals are to be raised in rows for cut flowers, to make a hedge, or as a row of vines to be grown on a fence or trellis, a convenient method of planting the seeds is to open up a drill or shallow trench by means of a draw hoe. The end of a rake may also be used for this purpose.

Thinning out the Seedlings

An important operation, and one that is often neglected in connection with the growing of annuals, is the thinning of the seedlings after they have germinated. This work should be done preferably when the ground is wet, on a cloudy day. The seedlings to be discarded may be pulled up with the greatest of ease under these conditions and there is less danger of disturbing and injuring the roots of the plants that are to remain in place. The distance allowed between the seedlings that are retained is, of course, dependent upon the size and habit of the mature plants. Small-growing plants, such as Virginian stock, may be allowed three to four inches; Shirley poppies, mignonette and other stronger growers require at least a foot between individual plants. Extend the operation of thinning over several weeks. There are occasionally such pests as cut worms and English sparrows to be found in the garden. It may happen that if the process of thinning is completed early, at one operation, these pests will take such toll from the remaining seedlings that not enough will be left to provide an adequate display. Thinning is necessary if we are to get the best results from our annuals. It allows the plants sufficient room to develop into healthy, vigorous specimens without undue competition from their neighbors, and it aids in prolonging the season of bloom.

Plants Raised under Glass

When plants have been raised under glass it is necessary to harden them by gradually exposing them to outdoor conditions before they are set out in the garden. If this precaution is not taken they are likely to suffer considerable injury when suddenly moved from the sheltered, shaded conditions of indoor life to the winds and glaring sunshine of the out-of-doors.

If pot-grown plants are to be set out, little or no root disturbance need be anticipated. They will grow along without any check, provided the soil is firmly pressed around their roots at planting time and they are not allowed to suffer from lack of moisture. But if the plants are growing in flats, it is necessary to exercise considerable care in removing them to avoid undue root injury. If the flats are made with one removable side, the moving of the plants with most of their roots is greatly facilitated.

A cloudy, moist day is also preferable for transplanting from flats. If the soil is at all dry, it should be watered thoroughly after the plants are set out. Should strong winds and bright sunshine make their appearance within a few days of transplanting, it may be desirable to shade any of the plants that show signs of wilting. This may be accomplished by placing berry boxes over them or by thrusting a shingle in the ground on the south side of the plant. These protective devices must, of course, be removed when the plants have become established in their new quarters.

Prolonging the Blooming Period

The whole object in the life of an annual is to blossom and produce seeds. When the plant has accomplished the task of perpetuating itself, its work is finished and it then dies. If, by removing faded flowers, we prevent the plant from seeding, its period of bloom is greatly prolonged. This is a practice that is thoroughly worthwhile when it can be done without its becoming too arduous a chore. Sweet peas and pansies in particular are benefited by this care.

I am not going to burden my readers with lists of annuals that should be planted. Those of you who are gardeners know better than I do what you like, and should be guided by your own choice. I would suggest, however, that the bulk of your planting consist of the old, established favorites—asters, snapdragons, phlox, zinnia, California poppies, petunias and marigolds—plants that you may rely upon to produce flowers over a long period. This does not imply neglect of the newer introductions. Try them, by all means, but don't plunge until you are sure that they will behave well under the specific conditions characteristic of your own garden.

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BROOKLYN BOTANIC GARDEN

LEAFLETS

SERIES XXII BROOKLYN, N. Y., MAY 9, 1934 NO. 7

STARTING PERENNIALS FROM SEED*

Seeds afford the amateur gardener a ready means of increasing his stock of *some* of the beautiful and interesting perennial plants he has used in the embellishment of his garden. It will be noticed that emphasis is laid on the fact that only some of the perennials may be increased in this way. Those which have been so highly developed by the plantsman and hybridist that they run to many different varieties do not, as a rule, come true from seeds, and hence are usually propagated by vegetative means, except when the object in view is the production of new varieties. Included in this group are such plants as iris and phlox. There is also another group, in which are included such plants as the peonies and some of the lillies, which take so long to come to the flowering stage when raised from seeds that the amateur is perhaps well advised to leave their production from seeds to the professional.

August Planting

August is the orthodox month for starting perennials from seeds. The theory back of the practice is that seeds planted at this time have an opportunity to develop into plants of sufficient size to be set out in their flowering quarters early in the fall. Furthermore, by planting the seeds as late as this, the gardener is not bothered with their care during the hottest part of the summer. As a matter of actual fact, not all of the perennial seeds that are planted in August are capable of developing into plants large and strong enough to withstand the winter without protection. Some of the slower-growing kinds, such as coral bells and the smaller campanulas, do not develop sufficiently fast to warrant their fall planting in the perennial border from August-sown seeds.

Personally, I much prefer to plant perennial seeds in May, if facilities and the opportunity for taking care of them are available. If this is done and if the seedlings are transplanted and not allowed to suffer from drought during the summer, they will make husky plants ready for planting in their permanent locations in the fall.

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* Digest of a broadcast given by Mr. Montague Free, Horticulturist of the Brooklyn Botanic Garden, in connection with Cooperative Extension Work in Agriculture and Home Economics of the State of New Jersey.

These plants will be strong enough to provide an abundance of flowers the following year.

The Seedbed

At this point it might be well to ask ourselves what is required in the way of facilities for raising perennials from seeds. It is, of course, possible to make a seedbed in the open ground and start the perennials there, but this is not the best method of handling the problem. If the seeds are planted in the open in this way, they are subjected to drenching summer rains. These drenchings may cause the total loss of the seeds by the erosion of the soil in which they are planted. The plan may work out satisfactorily for large-seeded plants such as the marshmallow, gas plant, and perennial pea, but for those having small seeds the protection of a cold frame is desirable. When a cold frame is used the plants may be protected from the heavy rains which, even if they do not wash the seeds away, at least batter the soil so that it becomes hard and packed about the tender seedlings.

The next question that arises is whether the cold frame should be placed in sun or in shade. Although shade has its advantages when the seedlings are quite young, sunshine is necessary later on in order that the plants may develop into stocky, sturdy specimens. On the whole, then, it is better to place the cold frame in a sunny situation and to use artificial shade, such as that provided by lath screens or burlap, until such time as the seedlings are able to withstand full sunlight.

The seeds may be planted directly in the soil of the frame, in flats, or in seed pots. If it is proposed to start a large quantity of one kind, it is perhaps better to plant the seeds directly in the soil of the cold frame. If only a few plants of many varieties are required, however, it is better to make use of flats or seed pots. The different kinds of seeds vary a great deal in the rapidity with which they germinate, and if a large variety is planted in the soil of the frame, some will have germinated and be in need of sunshine while the laggards will still be in need of shade. If, however, flats or seed pots are used, those in which the seeds have germinated may easily be moved to sunnier quarters, leaving the ungerminated seeds in the shade.

Pots should not be used for "long-winded" seeds, those which remain dormant during the winter and germinate the following spring. The reason for the avoidance of seed pots for this type of seed is that the pots are almost sure to be broken by the expansion which takes place when the moist soil contained in them freezes.

The Right Soil

The kind of soil in which they are planted has an important bearing on the success or failure of the seeds. For the best results, the soil should be light, porous, and well-tilled. If the seeds are to be planted in the soil of the cold frame, it should be dug up to a depth of at least six inches and thoroughly broken up with a spading fork. A liberal quantity of sifted leaf-mold should be mixed with it, as well as enough sand to make it porous. When this has been done, rake the surface of the soil with an iron-toothed rake, water it thoroughly, and allow it to stand for a week or so in order that it may settle before the seeds are planted.

If your plan is to plant in seed flats or seed pots, the soil may consist of two parts of good garden soil, one part of leaf-mold, and one part of sand, the whole mixture being sifted through a ½-inch sieve. Do not forget to place drainage material in the bottom of your flats or pots before filling them with the prepared soil.

Depth of Planting

Some of you may feel insulted at what I am about to say with regard to the depth of planting, and yet I feel that it is very necessary to emphasize the importance of planting the seeds at the proper depth. Some time ago, a lady came to me asking if I could throw any light on the failure of her seeds to germinate. Upon questioning, it appeared that the soil she used was all right and the location of the seedbed all that could be asked for. She had provided ideal conditions as far as moisture and temperature were concerned. Then, I asked her how deeply she had planted her seeds. When she said about one foot, I was able to tell her why her seeds had failed to germinate. It is impossible to lay down any hard and fast rule as to the depth at which seeds should be planted, but if you cover them with soil equal in depth to twice the diameter of the seed, or a little deeper in loose, sandy soils, you will not be going very far wrong.

Planting

Planting may be accomplished by sowing the seeds in drills or by scattering them on the surface and sprinkling them with the required depth of soil. The soil used for covering may be placed to advantage by sifting it through a fine sieve. If a regulation ⅛-inch sieve is not available, an ordinary flour sifter is an efficient make-shift.

When planting in drills, the shallow trenches for the reception of the seeds may be made by pressing the edge of a lath into the soil to the required depth, or by scratching the shallow trench with a pointed stick, using a lath as a ruler.

If you are reasonably sure that the seeds are viable and likely to germinate almost 100 per cent, be careful not to plant too thickly. If you plant the seeds thinly, so that each seedling has a chance to develop without being in too close proximity to its neighbor, there is much less danger of the seedlings succumbing to attacks of the deadly "damping-off" fungi.

Watering

When the seeds are planted, the soil should be thoroughly watered by means of a fine spray from a hose or watering pot. The moisture in the soil may be conserved by laying strips of burlap or some similar material directly on the ground over the seeds. If this practice is followed, it is most important to examine the seed frame every day and remove the burlap from those seeds which have germinated. It is necessary to shade the seedlings in their early stages. This may be done by nailing ordinary builders' laths about ¼-inch apart on a framing of 1 x 2 lumber. Still another method is to use a double thickness of cheese cloth or of something similar.

When the seedlings have formed their first rough leaf, they should be allowed much more sunlight. Gradually remove the shading until they are exposed to full sunlight. Perhaps it should be mentioned that ample air should be admitted to the cold frame at all times, the purpose of the sash being merely to prevent washing from torrential rains.

Transplanting

When the seedlings have been up for a few weeks, the stronger-growing varieties may be transplanted to another part of the garden. Space them three or four inches apart to allow plenty of room for development. These strong-growing kinds will be ready for their permanent locations in October. The weaker growers may be left in the cold frame until the following spring. After the first severe frost, scatter salt hay or similar protective matter over the seedlings and put on the sash. During very severe weather, the sash should be closed and the frames banked with partly decayed leaves or manure. In exceptionally severe climates further protection is afforded by means of mats placed over the sash.

Seeds should be obtained from reliable sources, preferably from dealers who specialize in seeds of hardy plants. If you want to be adventurous, it might be worth while to select some of the rarities and little-known varieties, and to experience thereby the thrill of having a unique collection. Believe me, it's lots of fun!

MONTAGUE FREE

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AUTUMN COLORATION

As the autumn lengthens, the age-old miracle of autumnal coloration in field, swamp, and hillside fills us anew with wonder and admiration. Like some famous magician who crowns his act with the cleverest trick of them all, Nature seems to be doing her best in this, her last act before her retirement, to demonstrate her versatility.

Two external conditions appear to be the causes of the brilliant autumn tints in the eastern United States and adjacent Canada: first, the bright and clear autumn skies, allowing the sunlight to penetrate the foliage and bring about photochemical reactions to the fullest extent; and second, the rather sudden drop in temperature, especially during the night, with the advent of the fall season. This colder weather retards the formation of chlorophyll, the green coloring matter in the leaves, which during the growing season is formed anew continually from day to day; and thus the yellow color, always present in the leaves, begins to appear more and more fully.

What is color? The physicists tell us that it is the property of substances to reflect particular waves of light. And of course we must note in addition that the sensitiveness of the retina of the human eye is also involved for a completion of the phenomenon, for just as there would be no sound were there no ears to hear, so there would be no color if there were no eye to see. If a substance reflects all of the waves of light it is white, if it absorbs them all, it is black.

On this basis, therefore, the reason for the autumnal coloration is clear. During the summer, leaves are green because they contain an abundance of the green pigment chlorophyll, a substance which absorbs all of the light waves with the exception of the green (and slight amounts of other colors.) The predominant green waves are reflected, thus giving the leaves a green color.

But, while chlorophyll is disintegrating and being formed anew continually by the plant during the growing season, it is then formed more rapidly than it is disintegrated: this is why the leaves keep green. Toward autumn, due to lowered temperature and other causes, "old age" of the leaf sets in, the leaves become less active, and the chlorophyll is manufactured less rapidly than it disintegrates. Here, then, other pigments begin to show their colors, some of which have been masked during the growing season by the chlorophyll. The principal one of these is xanthophyll, the yellow substance mentioned above, which is responsible for much of the yellow in our autumn foliage, as in the Birches, the Tuliptree, Elms, etc. Xanthophyll is more resistant than chlorophyll to the destructive action of light. Carotin may also be present, imparting a red or orange color depending on its relative amount. Other reds, as well as purples and blues, are due to the formation of anthocyanins.[1] If alkaline, these substances reflect the blue or purple shades, but an acid content results in a red coloration. The brilliancy of sumacs, sweet gum, oaks, and other trees is due to these pigments. Finally, oxidation changes them so that they reflect various shades of brown.

We are told that "not a few travellers from Europe time their visits to the United States so that they can witness the spectacle of the color splashed hillsides. . . . In order to help those who desire to enjoy the foliage, as well as those who hope to serve them, the New England Council is sponsoring an aerial survey of New England for the purpose of discovering to the best of its ability when the show is likely to begin, how long it will last, and where it will be most brilliant."[2]

Any group of judges would find it difficult to agree on the successful candidate for the prize for American autumnal coloration. Some prefer the Sweet or Red Gum (*Liquidambar Styraciflua*), which has a richness of color that is unique. However, this tree is not found in northern New England, being, in this neighborhood, near its northern limits. Others favor the Black Gum (*Nyssa sylvatica*), a rather uncommon tree which begins to show occasional scarlet leaves even as early as August. With others the White Ash, with its indescribable mixtures of purple and purple brown tints mingled with yellows, is most popular. And we must not forget the Flowering Dogwood, with its repertoire of brilliant colors which it varies to suit the season. However, our own vote goes to the Sugar Maple. Although its predominant color is a rich golden yellow, many of the outer leaves are often tinged with a glorious crimson. Some of these marvelously beautiful trees—we see them along the old village streets in this region and through New England—seem to have a glow of fire without, and when one looks further within, he sees the rich gold of the embers. Add to this the light fading green of some of the foliage, and the picture is complete. The Red or Swamp Maples are also brilliant, but their color combinations are not as varied, nor so satisfying.

The autumnal coloration within New York City is not marked, probably because the essential conditions named above do not exist. Anyone who knows the thick haze that envelops the great city as viewed from some New Jersey hill or Catskill summit must realize that, except on windy days, bright *clear* sunlight is a thing unknown.[1] Also, the huge piles of heated masonry, paved streets, and countless small heated dwellings undoubtedly modify the temperature.

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[1] Stout, A. B., Autumn coloration. Ninth Natl. Shade Tree Conference. Proc. 46-49. 1933.

[2] *Hartford* [*Conn.*] *Courant* for September 29, 1934.

Nevertheless, some of the trees and shrubs at the Garden are most attractive. In the Laboratory Plaza just west of the Laboratory Building, the border of dwarf Euonymus (*E. alatus var. compactus*) is a thing of beauty. During the last few weeks the thick foliage of this shrub has passed through many shades of red, purple, and crimson, with brighter colors, it seems, where it has the full benefit of the sunlight and the reflection from the concrete walks and the terrazo of the armillary sphere. The glossy green of the band of English Ivy bordering the Euonymus makes a most pleasing contrast.

One of Nature's finest paintings in the Garden is the view looking eastward toward Boulder Hill, from, let us say, the Hills Bridge, one of the northern boulder bridges. In the foreground to the right are Pin and Red Oaks, brown for the most part, but the former with a touch of crimson. In the center is a magnificent specimen of dark red Flowering Dogwood, and to the left the splendid dark green Atlas Cedars just hiding other Flowering Dogwoods still further to the left, while in the background are the greens and yellows of the London Planes on the summit of the hill.

Arthur Harmount Graves

THE CARE OF HOUSE PLANTS[2]

I. A WINTER GARDEN INDOORS

It seems that the farther north one goes in Norway the more extensive is the cultivation of house plants and the more profound the love for plants in the home. The implication to be derived from this statement is that the more rigorous the climate the greater becomes our need for indoor plants to cheer us with their beauty and to remind us that the "good old summer time" will come again. It must be admitted that the North American climate is sufficiently severe in the winter to provide the gardener with an incentive for making a winter garden indoors.

The extent to which such a garden will be successful depends largely upon the facilities available. If you have sunny windows and do not maintain the temperature of your house at too high a point — 68 degrees Fahrenheit is ample — the possibilities for a successful garden are practically unlimited. If you have some means of humidifying the air in the house your health will benefit and the chances of success with any plants you may have will correspondingly increase. If, on the other hand, your rooms receive but little sun and a temperature is maintained that ranges from 75 to 85 degrees with a corresponding drop in humidity, you must restrict yourself to the plants that are tough and resistant to such adverse conditions. In this group few of the so-called flowering plants are found, and the gardener must rely largely on such material as Snake Plants, Aspidistra, Dracaena, Palms, and Cacti.

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[1] "It is stated that during 1928 approximately 45% of the available daylight and 100% of the sun's ultra-violet rays were excluded from the city by reason of the smoke hanging above us. These figures are presented not as estimates but as the result of scientific measurement. (National Conference Board on Sanitation.)" From "Smoke Abatement in New York City." Municipal Art Society of N. Y. Bull. 32, 1929. See also Haas & Hill. An introduction to the chemistry of plant products. 4th ed. p. 337. 1928, and Ganong, W. F. A text-book of botany for colleges, p. 94. 1917.

[2] Digests of broadcasts given by Mr. Montague Free, Horticulturist of the Brooklyn Botanic Garden, in connection with Cooperative Extension Work in Agriculture and Home Economics of the State of New Jersey.

Three Plans for the Winter Garden

When planning your winter garden you may adopt one of three schemes for handling and displaying the plants. They may be grown in pots and arranged as artistically as possible on the window sill or on a plant stand near the window. The second method involves the use of window boxes that approximately fit the window space. The boxes are filled with soil in which the plants are set out. A third possibility is to grow the plants in pots and display them in window boxes, partially filled with moist peat moss in which the pots can be plunged. There are many advantages claimed for this system. It allows the plants to be artistically displayed without having their pots too much in evidence. Sickly plants are easily removed and replaced with others without disturbing the roots of the remaining healthy plants. The moist peat moss around the pots maintains an equable water content in the soil and makes it easy to keep the plants healthy.

Setting the plants directly in the soil of a window box has its advantages when the plants grown are permanent and when an attempt is being made to grow vines, such as English Ivy, to train around the window frame.

Self-Watering Window Boxes

For indoor use the so-called self-watering window boxes are preferable if porous soil can be used in filling them and if care is taken to avoid getting the soil water-logged when watering them. The water-tight receptacle in the base of these boxes does away with the annoyance of having water drop on the floor or rugs, a common and justifiable cause of complaint from housewives when the ordinary type of window box is used. If an old-fashioned window box must be used it is wise to provide it with a water-tight tray in which drips from the drainage holes may collect. Support the box on cleats, or some similar device, so that it does not actually stand in water.

Drainage for Plants in Pots

When plants are to be grown in pots it is advantageous to make use of a shallow, water-tight tray constructed to fit the window sill. This tray should be filled with small pebbles on which the pots may stand, and water must be maintained in the bottom of the tray. Such a contrivance will take care of drainage water from the pots, and the evaporation of water that takes place will help in a small measure to overcome the dryness of the air.

Use of Non-Bulbous Plants

Most of the flowering plants suitable for blossoming in the house during the winter belong in the group known as "spring-flowering bulbs," those which are forced so that they will produce their flowers at intervals from January to April. There are, however, a number of old standbys among the non-bulbous plants that may be relied upon. These include the Horseshoe Geranium, sometimes called the House Geranium, the Wax Begonia, and several other varieties of Begonia, the Calla Lily, Freesia, Zanzibar Balsam, Christmas and Crab Cactus, Cyclamen, and Chinese Primrose. The Poison Primrose is also a good house plant, but some persons get a rash from handling it similar to the rash caused by Poison Ivy.

Reasons for Failures with Indoor Gardens

Why is it that some of us have such poor success with our indoor gardens? The chief reason for their failure is that they are frequently kept in rooms that are too hot. In country districts where there are no modern systems of heating, where steam radiators are unknown, there is no great difficulty experienced in growing plants in the home. Keep your plants as cool as is possibly consistent with your own comfort, give them all the light available, water only when the soil begins to dry out and then water thoroughly, and most of your house plant troubles will be things of the past.

Plants for Low Temperatures

The Japanese Camellia and the Indian Azalea are plants that thrive under cool conditions. They can stand the temperature when it drops to 40 degrees or even to 35 degrees. If you have a sun porch that is unheated, grow plants such as those and bring them into the house only when you think the temperature on the porch is likely to go below the freezing point. English Ivy, too, will thrive under such conditions and, of course, will survive freezing.

Spring Flowering Bulbs

Considerable reliance should be placed on spring flowering bulbs, for they will help to provide a continuous bloom. Bring a few pots of bulbs indoors from your outdoor plunge pit at intervals of two or three weeks, starting about Christmas time. Do not try to force the bulbs into bloom too quickly, for rapid forcing is the commonest cause of blasted flower buds. Keep them for two or three weeks in a temperature of about 50 degrees: they may then be exposed later to a temperature of 65 or 70 degrees without injury to the flower buds. When the flowers have withered, the bulbs should be removed from the winter garden, for their ripening foliage is unsightly. Either discard them or place them in the spare room where they are exposed to the light: they may then be watered until the leaves have turned completely yellow. Then withhold water until the fall, when the bulbs may be planted in the outdoor garden with the expectation that in a year or two they will blossom again. Do not attempt to use forced bulbs for forcing two years in succession.

And now a word or two regarding the insect pests that may possibly bother the winter garden — scales, mealy bugs, red spider and plant lice. What shall be done to prevent their attacks? The Saturday night bath is a world-wide institution. Establish a Saturday morning bath custom for your house plants and you will find that it is the best measure you can use to keep them free from severe insect attacks. A spray of clear water, properly applied, is very efficacious in upsetting the domestic arrangements of most of the insect pests. Place the plants on their sides in the bathtub and spray both upper and lower surfaces of the leaves with water from the hose, using it with sufficient force to dislodge the insects and wash them down the drainpipe but not so forcibly as to injure the foliage. If your plants are blossoming, keep the water away from the flowers as much as possible unless they, too, are infested. The advantage of growing plants in individual pots is now apparent, for by using this method it is easy to control any insects that may have infested them. If it is not convenient to remove the plants to the bathtub or to some place where the water may be used freely, one must have recourse to a contact insecticide of some kind. Use either nicotine-soap solution or one of the many proprietary insecticides, and spray the plants or dip them, whichever is more convenient.

Insect Pests

The secrets of success in winter gardening may be summarized as follows: Keep the plants cool and the air humid; provide an abundance of light; give careful attention to watering; take prompt action when insect pests are discovered; and select the right kind of plants.

II. REPOTTING AND DIVIDING HOUSE PLANTS

For more than twenty years I have been lending a receptive ear to the troubles of growers of house plants. It has seemed to me that about 75 per cent of these anxious indoor gardeners start the conversation by saying that there is something wrong with their Pandanus, Sansevieria, or whatever it happens to be, and that it needs repotting. "What kind of soil," they ask, "should the plant be given?"

In about 50 per cent of these cases the trouble has been brought about by unsuitable atmospheric conditions, improper watering, or insect attack, rather than by need of repotting. Plants do need repotting occasionally, however, sometimes because they are growing vigorously and have become potbound, sometimes because the soil has become water-logged and sour, and the roots, as a consequence, are unhealthy.

Several varieties of the plants commonly grown in the house, such as Pandanus, Sansevieria, and Palms, seem to thrive better when their roots are somewhat crowded. These plants should not be moved into larger pots unless their roots are so crowded that growth is no longer healthy and vigorous. Instead of repotting, remove as much soil as possible from the surface without disturbing the roots of the plants and replace it with a rich mixture made up of

Repotting Not Always Necessary

equal parts of sandy loam and thoroughly decayed manure. Supplemental feeding of a "complete" commercial fertilizer, containing nitrogen, phosphorus, and potash, may be given at the rate of a level teaspoonful to a six inch pot. If the plant is healthy and growing vigorously this fertilizer should be applied to the surface of the soil every 3 or 4 weeks and scratched in.

The best kind of soil for most house plants is one formed of loam cut from the upper four or five inches of meadow, pasture or lawn. It should be mixed with stable or barnyard manure, in the proportion of two or three parts of soil to one of manure, and left for a year or more in order that the grass and manure may decay. If grass sods are not available use garden soil. Turning over the heap once or twice in the course of the growing season accelerates decay. With this soil as a base, one may be made which will be a suitable potting medium for almost any class of plants by the addition of sand, leaf-mold, or peat, as the case may demand. With begonias, for instance, use enough sand to make the soil porous and add one fourth of its bulk of leaf mold. For azaleas and camellias, which require an acid soil, add one third or one half of peat or peat moss to a sandy base soil.

Pots for the Plants

The pots to be used in repotting must be washed clean inside and out and should not be very much larger than the pot in which the plant is growing. For sizes up to six inches, one half inch clearance between the ball of soil and the inside of the pot is usually adequate. For sizes over six inches, allow one to one and a half inches clearance.

Put a piece of a broken pot, concave side down, over the hole in the bottom of the pot and upon it place a thin layer of broken pot or coarse ashes to provide drainage. Place the new soil, which should be neither wet nor dust dry, on the work bench or table and you are ready to start operations.

Remove the plant from the old pot by turning it upside down and tapping the rim of the pot on the edge of the bench. Remove the old drainage material at the base of the plant if it can be done without injury to the roots. If the roots are greatly matted around the outside of the ball of earth, it is a good plan to loosen them by means of a pointed stick, taking care not to break the roots too much in the process. Any loose soil on the surface of the ball should be removed before placing the plant in the new pot. Having prepared the plant for its new quarters, place a handful of partially decayed leaves, from which the fine material has been sifted, over the drainage in the bottom of the pot. Follow this with a handful of the prepared soil and place the plant in position. It should be planted deep enough to bring the top of the old ball of earth about one inch below the rim of the pot. Be sure to get the "ball" in the center of the pot. When it is placed to your satisfaction, fill it in with soil, occasionally jarring the pot upon the bench to shake the soil down. After this has been done, use a thin slat of wood, a piece of lath will do, to tamp the new soil until it attains the same degree of firmness as the soil in the old ball. Add more soil if necessary to bring the finished surface up to within ¾ of an inch of the pot rim. This space between the surface of the soil and the top of the pot facilitates watering. I have found that many amateurs completely fill the pot with soil. When this has been done the only effective way of properly watering the plant is to stand the pot for a few minutes in a vessel of water, a process that is not always as convenient as watering by means of a watering can.

When you have finished repotting your plants, water them thoroughly, but do not water them again until the earth begins to dry out. Much harm may be occasioned by over watering newly potted plants. When the new soil has become filled with roots, greater liberality in the matter of watering may be practiced.

Repotting for Unhealthy Roots

When a plant has to be repotted because the soil has become water-logged and the roots, as a consequence, unhealthy, the best method is to take the plant from the pot, shaking as much soil as possible from the roots and washing off the remainder either by swishing the roots up and down in a pail of water or by allowing water from the faucet to run over them. When the roots are clean, look them over carefully and cut off with a sharp knife any that are decayed. Set the plant in a pot just large enough to accomodate the roots without overcrowding them. The soil used for repotting these sickly plants should not be rich. Use garden soil and sand, half and half. Spread the roots as much as possible, place the soil between them, and make firm with the fingers. When healthy roots are formed, give supplemental feedings or repot in a larger pot using the rich soil mixture previously advised.

No definite rule can be laid down as to when plants should be repotted. If they are making vigorous growth the work may be done at almost any time, but, as a general rule, repotting is done to the best advantage just before the plants begin their new growth, usually in January or February.

Dividing House Plants

Sometimes it is desirable to divide the plants instead of shifting them into larger pots. When this is done it is possible to make two or more plants from one. Such plants as Aspidistra, Sansevieria, and many of the ferns lend themselves admirably well to this form of propagation. Preferably the dividing should be done immediately before new growth starts. Turn the plants out of their pots, shake most of the soil from their roots, and break them apart, using the fingers and a knife if necessary. The divisions should be potted up as previously described. When watering these newly divided plants avoid getting the soil into such a condition that it is constantly soggy.

Before repotting your plants be sure that they really need this care. Much of the unhealthiness of house plants may be traced to an attempt to grow them in pots that are too large. Furthermore, remember that it is the plant that should be beautiful, not the pot.

Montague Free